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Workload Management System for Nurses: Application to the Burn Unit

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A patient acuity classification is required by the Joint Commission on Accreditation of Healthcare Organizations, and this is vital in providing safe, cost-effective nursing care. The Workload Management System for Nurses (WMSN), which is based on direct and indirect nursing care research, prospectively classifies patients on the basis of direct care requirements and then establishes staffing levels on the basis of both direct care and indirect care workloads. Application of the Department of Defense WMSN to the military burn research center is feasible and has provided data for objective staffing adjustments and validated staffing requirements. In addition, several other quality assurance implications have been realized as a result of implementation of the system. (J BURN CARE REHABIL 1990;11:267-74)

A patient acuity classification system that is integrated with a staffing methodology is a crucial element in providing safe, cost-effective nursing care in the current health care environment. The data collected through the use of such a system can be used not only at the work center level to project staffing requirements for the next shift but also by the nursing administrator for long-range resource management.

Even though no perfect classification system exists, an objective means of forecasting patient care needs makes effective nursing unit management possible. An effective system will combine patient care requirements with a staffing methodology that reflects the mix of nursing care providers needed to ensure quality care and staff satisfaction.[1,2]

The Workload Management System for Nurses (WMSN) is a combined effort of the Army and Navy
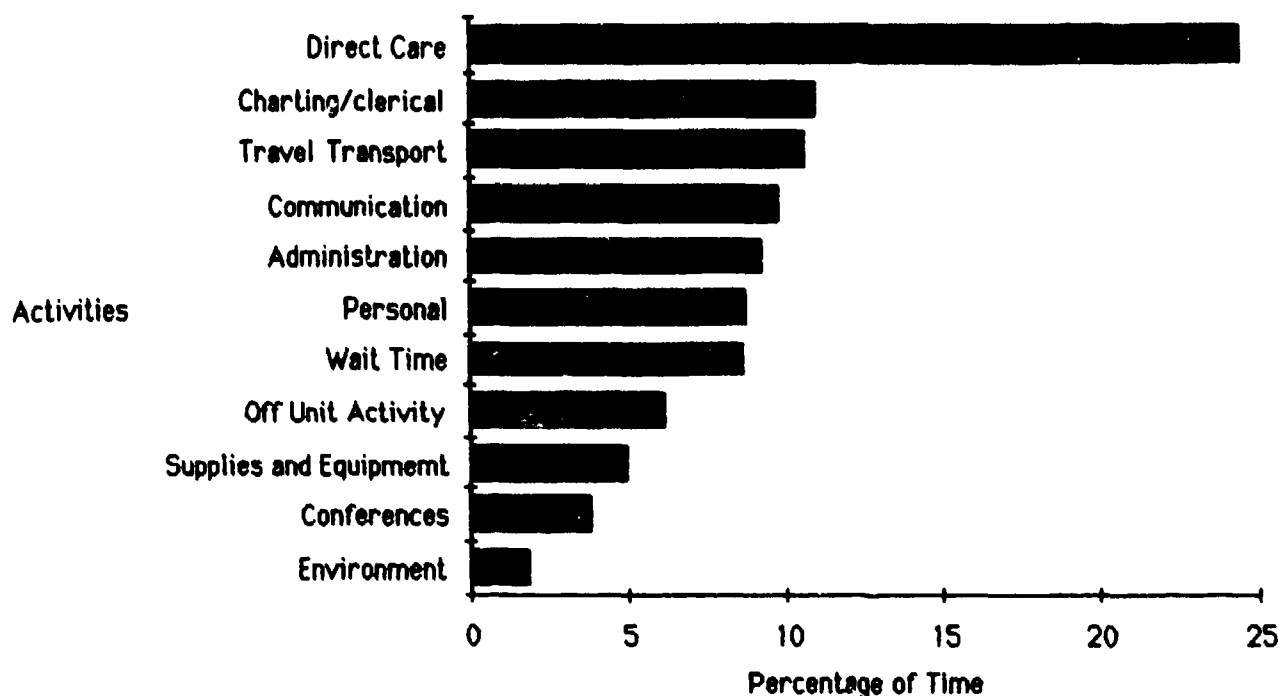
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Figure 1. Percentage of time spent by nursing personnel in 11 activities.

Nurse Corps to establish a valid, reliable patient classification system that is combined with a staffing methodology. Application of this system to the U.S. Army Institute of Surgical Research (Army Burn Unit) is the focus of this paper.

DESCRIPTION OF THE WORKLOAD MANAGEMENT SYSTEM FOR NURSES
Research Foundation

Any valid and reliable classification system must be based on research. The WMSN merged data from the Nursing Care Hour Standards Study and from the Time Spent in Indirect Nursing Care Study, both conducted by the U.S. Army Nurse Corps, Health Care Studies Division of the Army's Health Services Command. These studies were combined with work done by the Navy in the development of a classification tool.[3-6]

The Nursing Care Hour Standards Study was designed to achieve seven objectives:[3]

1. Development of a nursing care activities tasking document.
2. Determination of minimal essential mean task times for frequently occurring direct nursing care activities.
3. Determination of the skill level and number of

personnel needed to perform the direct nursing care activities.
4. Determination of the frequency rate of the direct nursing care activities by documentation of care requirements.
5. Determination of categories of care utilizing the documented direct nursing care requirements, minimal essential mean task times, and the mean number of nursing personnel required to perform the direct nursing care activity.
6. Development of a factor-evaluation–designed patient classification system for critical care, medical-surgical, obstetric, psychiatric, neonatal, and pediatric clinical services that would provide a better staffing mix based on quantified direct care requirements.
7. Determination of the validity and reliability of the classification subsystems for various clinical services.

The investigators evaluated the effect of age and sex of patients on the minimal essential mean task time for each of 357 direct nursing care activities. Direct nursing care activities were delineated and defined through Delphi studies that utilize the expertise of professional nurses and the analyzed data of 528 inpatient clinical records.

Four phases of the study were completed over a

period of 4 years. In Phase 1, the direct nursing care activities tasking document was developed. It is notable that these tasks did not include time to set up equipment and supplies or time to clean up after the task was completed. Minimal essential mean task time for each direct nursing care activity was determined through direct measurements in Phase 2. Phase 3 activities documented patient needs for direct care through frequency rates of nursing care activities. Finally, a factor-evaluated patient classification system was developed in Phase 4 for each of the specialty areas. Content-related validity and criterion-related validity for all six tools were established. Interrater reliability was established by comparing scores of two independent raters who assessed 8350 inpatients. Pearson's correlation coefficients for the total scores were 0.91 for critical care and 0.85 for medical-surgical care. Coefficients were statistically significant ($p < 0.001$). Two independent raters' Patient Indicator scores were analyzed to determine whether the individual responses to the various indicators were consistent. Correlation coefficients were used to compare the raters' scores for each Patient Indicator. Student's t tests with N-2 degrees of freedom were computed for all coefficients. Ninety-three percent of the coefficients achieved significance at the 0.05 level or better.[3]

The final instruments developed by Sherrod et al. were time-consuming to complete; therefore, indicators of care were reduced through merger with results of a U.S. Navy Nurse Corps study. The critical indicator tool developed in that study had high interrater reliability but was not based on the extensive timing studies done by the Army Nurse Corps.[5] Validity for the new tool that resulted from the merger was studied for 4 months in five U.S. Army hospitals and extensively in several U.S. Navy hospitals. The Pearson Product Moment correlation between the new tool and those tools developed in the Nursing Care Hour Standards Study was $r = 0.89$.

Variation in reliability of total scores between two independent raters had a correlation coefficient of $r = 0.93$. The ratings between staff nurses and two investigators using the Goodman-Kruskal Gamma test were 0.957 and 0.960, respectively. Between in-

Variation in reliability of total scores between two independent raters had a correlation coefficient of $r = 0.93$. The ratings between staff nurses and two investigators using the Goodman-Kruskal Gamma test were 0.957 and 0.960, respectively. Between investigators, the Gamma score was 0.99. These results indicate that the final worksheet of critical indicators is valid and reliable. Once trained, a nurse can complete the assessment of nursing care
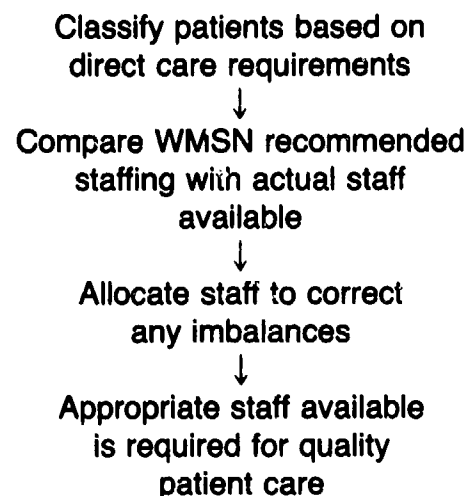
**Classify patients based on
direct care requirements**
↓
**Compare WMSN recommended
staffing with actual staff
available**
↓
**Allocate staff to correct
any imbalances**
↓
**Appropriate staff available
is required for quality
patient care**

Figure 2. Dynamics of the Workload Management System for Nurses.

Table 1. Categories of care: WMSN

Categories/point range	Description
I (0-12)	Self or minimal care
II (13-21)	Moderate care
III (32-63)	Acute care (1 staff to 3 pts)
IV (64-95)	Intensive care (1 staff to 2 pts)
V (96-145)	Continuous care (1 staff to 1 pt)
VI (146-)	Critical care (>1 staff to 1 pt)

Staff, staff member; pt, patient.

hour (NCH) needs using the tool in approximately 5 minutes.[7]

To complete the final process of developing a staffing guideline to reflect both direct and indirect care time, the Army Nurse Corps studied the time spent in indirect nursing care.[4] The question answered was: what percentage of time is spent by inpatient nursing personnel in each of three temporal categories: direct care, indirect care, and time unavailable for patient care? Data were collected in nine military hospitals with the use of a tool adapted from Murphy et al.[8] The six clinical services used were comparable to those used by Sherrod et al.[3] Nursing personnel were monitored every 10 minutes over ten 8-hour shifts (including days, evening, and nights) in all nine facilities for a total of 107,700 data points. Personnel classifications included: head nurse, wardmaster, registered nurse, practical nurse, nursing assistant, and ward clerk.

Table 2. Nursing care hour requirements for critical care unit

	Category					
Patients	I (points)	II* (points)	III (points)	IV (points)	V (points)	VI (points)
1	/	/	10	17	25	43
2	/	/	20	34	51	85
3	/	/	30	50	76	128
4	/	/	40	67	101	171

* Category I and II patients are not in critical care units.

Table 3. Daily personnel requirements chart: critical care

		Days			Evenings			Nights		
NCH range	Total 24-hour staff	RN	LPN	NA	RN	LPN	NA	RN	LPN	NA
1-48	6	1	1	0	1	1	0	1	1	0
193-200	25	5	3	1	5	2	1	5	2	1
201-208	26	5	3	1	5	3	1	5	2	1

NCH, Nursing care hour requirements; NA, nursing assistant or ward clerk.
Example of 196 NCH = 25 staff members for 24 hours.

Misener et al.[4] found that across all facilities, indirect care accounted for 60.5% of the time. Direct care was measured at 24.5% of the time, and nonproductive time equalled 15%. Figure 1 shows the percentage of time spent by nursing personnel in 11 activities across all facilities. Unavailable time is the combination of personal time and off-unit activities. Most off-unit activities were related to military training requirements. Additionally, it was found that direct care time increased as the number of registered nurses increased. These results were noted by the investigators to be consistent with those reported in the civilian nursing literature.[4,6,9]

Final staffing tables for the WMSN delineate indirect care time, 60% for critical care units and 76% for medical-surgical units.[6,9] The WMSN tables developed for these two clinical areas were used to project staffing for the Institute's 16-bed critical care burn unit and 24-bed acute care burn ward.

The WMSN can be used manually (with tables provided in a workbook), or in automated form with software that computes NCH requirements and staffing requirements. The software also produces several daily and monthly reports that assist managers in making staffing decisions and documenting staffing requirements.

Components of the Workload Management System for Nursing

The WMSN is an integrated system by which one assesses and classifies patients, allocates and assigns personnel, and evaluates and monitors care given (Figure 2). It is implemented through a patient classification instrument of factor-evaluation design that requires a registered nurse to assess nine groups of factors related to direct patient care and to assign an overall score to each factor.

Assessment of care is prospective for the next 24 hours. The weighted scores are totalled and patients are classified into one of six categories ranging from 1 (minimal care) to 6 (greater than one-to-one care) (Table 1). On the basis of the "Category of Care" classification, NCH requirements are totalled for all patients on the unit. The total NCH requirements then determine staffing required for the next 24 hours on the basis of tables that incorporate both direct and indirect care needs. This process is outlined in the manual format as follows:

Table 4. Direct and indirect care time defined

Direct care	Activities that take place in the presence of the patient/family	1. Place equipment at bedside 2. Explanations 3. Preparation of the patient 4. Do task 5. Remove equipment 6. Bedside charting 7. Assessment and observation 8. Teaching
Indirect care	Activities, conditions, and circumstances that necessitate time over and above direct care	1. Charting 2. Transcribing 3. Phone calls 4. Clean up
	Includes unpredicted needs that occur due to changes in patient's condition, admission, delay and stand-by, care conferences, personal time, and staff education.	

WMSN: Manual Format for Determining Nursing Care Hours and Staffing Requirements

1. Classify patients using acuity worksheet. Based on the point value obtained, the patient is classified into one of six categories.
2. Total the number of patients in each category. Using the Nursing Care Hour Requirements table, determine the total number of nursing care hours required (direct and indirect care) for the entire unit. Example:

1 CAT III patient(s)	=	10 points
3 CAT IV	=	50
2 CAT V	=	51
2 CAT VI	=	85
8	Total NCH =	196

See Table 2 for more details.

3. Using the Daily Personnel Requirements Chart, determine the recommended number and mix of staff (Table 3).
4. Compare recommended staffing and mix with actual staffing and mix. Assess patients for actual required level of care based on patient care

Table 5. WMSN: patient classification factors

- Vital signs
- Monitoring
- Activities of daily living
- Feeding
- IV Therapy
- Treatments, procedures, medications
- Respiratory therapy
- Teaching and emotional support
- Continuous*

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* This category allows the nurse to automatically classify the patient as requiring one-to-one coverage or greater than one to one coverage. It is rarely used because documenting the care actually required with critical indicators is more objective.

needs and scope of practice of staff. Ensure appropriate number of staff and correct mix based on professional judgment as related to critical indicators of care required.

The same process occurs automatically in the computerized format once acuity indicators are entered for each patient on the unit. Although skill mix guidelines are given, it is the professional nurse's responsibility to assess each patient and to make care assignments based on the needs of the patient for a particular level of care giver. For definitions of direct and indirect care see Table 4. Nine groups of critical indicators that cover one specific domain of activities are outlined in Table 5. Those activities on the classification tool that have the greatest impact on direct care time (i.e., critical indicators) are shown in Figure 3. Points are assigned to each specific critical indicator on the basis of documented time and motion studies. Each point is equal to 7½ minutes of direct nursing care time (in parentheses in Figure 3). The instrument used to determine direct care time is called "The Patient Acuity Worksheet" and may be used manually or with automated systems (Figure 3).

In 1988 a project was initiated to determine whether the WMSN is valid and reliable in determining staffing requirements for the burn critical care unit and the acute burn care ward. A panel of seven burn nurses evaluated each indicator on the tool and determined that the indicators were valid for burn care. Each indicator, as operationally defined in the WMSN workbook, was subjectively related to how the task is performed in the burn unit. The only indicator that was questionable was the complex dressing indicator.

Unit:_____ Date:_____ Time:_____

Signature:_____

PATIENT ACUITY WORKSHEET

Point Values	CRITICAL INDICATORS	Acuity Code				
------	--	----				
	MONITORING					
(2)	Intake and Output q 8h x 3	(11)				
(8)	Intake and Output q 2h x 12	(12)				
(2)	Circulation or Fundus Check q 2h or x 12	(13)				
(3)	Neuro Checks q 4h or x 6	(14)				
(6)	Neuro Checks q 2h or x 12	(15)				
(2)	CVP or ICP (manual) q 2h or x 12	(16)				
(6)	Cardiac/Apnea/Temp/Pressure monitor (not cummulative)	(17)				
(6)	Transcutaneous Monitor	(18)				
(4)	A-line or ICP (Monitor) or Swan Ganz set-up	(19)				
(2)	A-line or ICP (Monitor) reading q 2h or x 12	(20)				
(2)	PAP/PA Wedge Reading q 4h or x 6	(21)				
(4)	PAP/PA Wedge Reading q 2h or x 12	(22)				
(2)	Cardiac Output tid or x 3	(23)				

Figure 3. WMSN: Patient Acuity Worksheet.

WMSN: Operational Definition of Complex Dressing Change

COMPLEX DRESSING CHANGE (>30 Minutes to complete): 4 points. Includes time to place equipment at bedside, remove soiled dressing, don gloves, administer irrigation solution if needed, reapply dressing, and remove equipment from the area.

On the basis of the operational definition of this indicator, the panel was unable to determine whether the definition accurately reflects the time required for

burn dressing changes. The panel decided that the registered nurse responsible for a patient's classification would compute the time needed for the patient's dressing changes for 24 hours and then calculate the point score representing that time (each point equals 7½ minutes). To facilitate reliability in recording the number of points on the acuity sheet, the calculated value is recorded in the chart next to the order for the dressing change.

An information paper was prepared to clarify which code was to be used for nursing care activities

specific to the unit's policies and procedures. For example, code 82 ("Other activities requiring >15 minutes and <30 minutes") is to be used to record irrigations, thus assigning two points (the equivalent of 15 minutes) for this activity for the 24-hour period. Staff members were then trained to use the system accurately.

A core of nurses was selected to do the interrater reliability testing each month for the two units. This group ensured interrater reliability scores of 100% among the members by rating the same four patients on each of three occasions. Interrater reliability scores between the core group and the staff on the two units for "patient category" have been 80 to 100% each month for the past year. Reliability scores for specific factors varied from a low of 20% to a high of 100%. Factors that had the lowest reliability scores (20% to 60%) are "IV Therapy" and "Treatments and Procedures." Extensive inservice education of the staff has improved these scores in recent months. In addition, staff members have begun to establish interrater reliability among themselves with the standard being a minimum of 85% for "category of patient" scores.

This project has resulted in several positive benefits for the unit in terms of professional development of the staff and quality assurance monitoring and evaluation. The WMSN classification system can be used in a burn unit with minimum adaptation. Because this system is used throughout military facilities in the Department of Defense, administrative training time for the nurses assigned to the unit is decreased when they arrive from another military facility. This is an essential benefit because of the programmed turnover of military nurses.

Each year the staffing authorizations of the Institute are reviewed by the Department of the Army. Data from the WMSN validates the staffing requirements, thereby decreasing the chance for an unjustified reduction in authorized staff. In addition, the data establish the requirement for a Registered Nurse-to-Practical Nurse mix of personnel at approximately a 60:40 ratio for the critical care unit and a 40:60 ratio for the acute care ward.

As the staff members have become involved with projecting staffing requirements to accomplish the projected workload, they have learned to review care plans and orders carefully to determine the continued need for selected nursing care activities. Many routine practices and policies have been questioned and reevaluated. For example, it was an established practice to obtain a complete neurologic assessment every hour during the resuscitative phase. The unit policy

was changed to reflect that this is not a routine need and that only the patient's level of consciousness needs to be assessed every hour. In addition, this periodic review provides a mechanism for enhancing collaborative practice between physicians and nurses.

Research is a primary mission of the Institute, and the process of adapting the WMSN to the burn unit has stimulated the staff to become more active in research activities. Because of the uncertain validity of the complex dressing application/change indicator, the expert nursing panel believed that a more objective measurement of time required for this activity was indicated. Currently, there is a study being conducted to measure the time required for procedures related to wound care. In changing policies and procedures, more emphasis is being placed on critical review of the research related to the issue that is being reevaluated.

Of interest in this project (and in the study of Sherrod et al.[3]) is the finding that classifying a patient into one of six categories does not always reflect the level of personnel that is needed for that patient's care. The WMSN staffing tables reflect results from the study of Sherrod et al.[3] concerning the types of personnel performing particular tasks. Some factors on the acuity worksheet contain more indicators of care that require professional nursing judgment than other factors do. For example, two patients could be classified into category V, but one may have more care requirements related to dressing changes and treatments and one may require more complex hemodynamic monitoring and nursing analysis of the data obtained. The first patient could be safely managed by an LPN with supervision, whereas the second patient would require a professional nurse's continual care. This finding needs to be evaluated more thoroughly. Currently, each patient in the unit is assessed daily by a professional nurse to determine NCH requirements and the level of care provider required. Evaluating the type of indicators of care as compared to the unit's written scope of practice for practical nurses assists with this decision. Since the project has begun, nursing managers perceive that charge nurses have been making better staffing decisions related to acuity of care required and that there is a more active interest in unit quality assurance activities.

CONCLUSION

Application of the Department of Defense's standard patient classification and staffing system, WMSN, is feasible in a 40-bed military burn center. Data de-

rived from this system has validated staffing requirements objectively and provided a basis for daily staffing decisions. Positive benefits observed from the implementation of the WMSN include: decreased administrative training time because the system is used throughout the Department of Defense military medical facilities; validation of the required mix of professional to paraprofessional nursing personnel; documentation of staff productivity levels; and enhanced nursing research activity and increased utilization of research results.

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